Original Research Article

Comparison between a modified three bend cystitome and conventional two bend cystitome in performing capsulorhexis

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Abstract

Aim: To evaluate the efficacy of a modified 3-bend cystitome compared with conventional 2-bend cystitome in performing continuous curvilinear capsulorhexis(CCC). **Materials and Methods:** We modified a 2-bend cystitome for CCC for Manual Small Incision Cataract Surgery and phacoemulsification surgery for improved safety and easier surgery. A 26G needle was converted into a cystitome with 3 bends. In our study, the performance of modified 3-bend cystitome was compared with a 2-bend cystitome. 162 eyes of 126 patients were included in our study. **Results:** In the 3-bend cystitome group, mean completion time of CCC and the viscoelastics used were less with the CCC success rate being higher. Complications like postoperative corneal edema and V-shaped tears, were also lower in 3-bend group. No posterior capsular rents or any other complication was observed in either group. **Conclusion:** It is safe, efficient and the 3 bend cystitome helps achieve a CCC while maintaining the anterior chamber depth (ACD) by keeping the posterior lip intact. The 3-bend cystitome allowed for adequate visualisation into the anterior chamber from a lack of wound deformation.

Key Words: Capsulorhexis, Cataract, Cystitome, Phacoemulsification, SICS

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INTRODUCTION

Capsulorhexis means tearing the capsule of the crystalline lens. It is a standard and critical step of anterior capsule opening in modern cataract surgery. This technique facilitates to obtain a smooth, circular, capsular opening with a strong capsular rim that resists tearing during various procedures like lens material removal or lens implantation.[1] Cystitome and forceps are commonly used for a continuous curvilinear capsulorhexis (CCC), even though femtosecond laser produced capsulotomies are more precise, accurate, reproducible, and stronger. [2-5] The benefits of using a cystitome for capsulorhexis compared to a pair of forceps include better view of the capsulorhexis edge, less corneal wound distortion and reduced loss of the viscoelastics. Also, the cystitome can be fixed to a syringe containing the viscoelastics, which allows viscoelastic agent supplementation if needed [6]. Additionally, a cystitome is cheaper than a pair of forceps. To perform a good CCC, a stable anterior chamber is needed, conventional cystitome has 2 bends, which may not keep the depth of the anterior chamber as stable as needed. In our study, we evaluate the efficacy of a modified 3-bend cystitome compared with conventional 2-bend cystitome in performing continuous curvilinear capsulorhexis.

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MATERIALS AND METHODS

This was a retrospective study done on patients who had presented to Kempegowda Institute of Medical Sciences Bangalore. The medical records of all cases from June 2017-May 2018 with cataract were retrieved and reviewed. 126 patients covering 162 eyes were included in our study. All the cases were performed by a single surgeon.

Exclusion criteria were

- Paediatric Cataracts
- Zonular laxity/dehiscence
- Anterior Capsule Calcification
- Posterior Synechia
- Hypermature Cataract

Methodology

Informed consent for retrospective data analysis was obtained from cataract surgery candidates after explanation of the nature and possible consequences of the study were obtained.

Table 1: Demographics

Demographics	2 bend group	3 bend group
AGE	55±3.8	54±4.1
MSICS/PE ratio	3.8	4.2
Female:Male	1:1	1:1

This study includes 162 eyes of 126 patients and subjects divided into 2 groups:3 bend cystitome group (Case):90 eyes,73 Manual Small Incision Cataract Surgery (MSICS),17 phacoemulsification 2 bend cystitome group (Control): 72 eyes,57 underwent MSICS, 15 Phacoemulsification A pre-structured proforma is used to collect the baseline data. Detailed ocular clinical examination is done .Snellen's chart is used for testing visual acuity.Perkins applanation tonometer is used to measure intraocular pressure. Indirect ophthalmoscopy (IDO),Slit lamp biomicroscopy with +90D lens for fundus evaluation. Slit Lamp biomicroscope is used to evaluate anterior and posterior segment pathologies. Upon examination, the degree of lens opacity will be graded according to the Lens Opacities Classification System (LOCS III) grading guidelines.

Techniques of Making and Using a 3-Bend Cystitome

Using a needle holder, we bent a 26G needle thrice to make a 3 bend cystitome. Compared to the conventional 2-bend cystitome, a 3-bend cystitome has an extra bend in the middle. The three bends are 90° at the bevel, 120° at the hub, and 150° at the middle point (Figure 1). The bend made at the middle can be adjusted according depth of the anterior chamber (ACD).

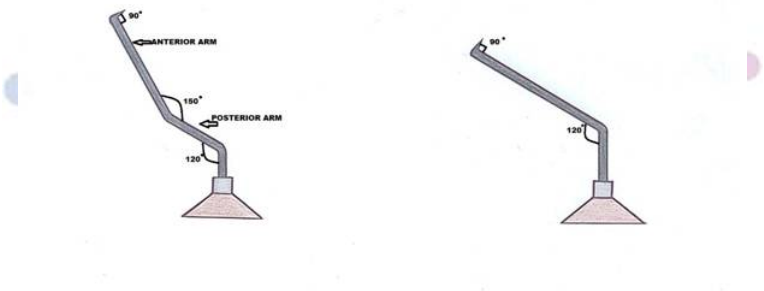

Figure 1: Diagrammatic representation of 2- and 3-bend cystitomes. In comparison to the 2-bend cystitome, the 3-bend cystitome has an extra bend at the centre. The three bends being at 90° at the bevel, 120° at the hub, and 150° at the centre point.

The capsulorhexis made with a 3-bend cystitome is the same as how we do it for routine capsulorhexis with a 2 bend cystitome. Capsulorhexis of 6 mm is made in either a clockwise or counter clockwise direction. The flap is torn either by the ripping force or shearing force.

Manual Small Incision Cataract Surgery(MSICS)

A fornix-based conjunctival flap was made under peribulbar anaesthesia, A 6.0-7.0 mm straight scleral incision 1.5 mm from the limbus made, avoiding the major scleral vessels. A superficial scleral tunnel was dissected to the clear cornea using a crescent blade. A side port entry site was made at the 9 o'clock position. The anterior chamber was entered by making an entry through the clear cornea using a keratome. The anterior chamber was filled with viscoelastics and a 6.0 mm diameter capsulorhexis was initiated using a cystitome. After hydrodissection of the nucleus, a Sinskey hook was used to dial the nucleus in anterior chamber. To perform the nuclear extraction, the Sinskey hook was held in the right hand and vectis was held in the left hand; the tip of the hook was then embedded into the nucleus. Right hand was used to pull the nucleus and the left hand pressed on the scleral bed. Throughout the procedure, care was taken not to fiddle with the iris or capsule. The residual epinucleus was hydroexpressed using a Simcoe cannula. After aspiration of residual cortex, a polymethyl

methacrylate(PMMA) intraocular lens (IOL) was implanted in bag and the sclera corneal wound verified to ensure it had self-sealed. No sutures placed.

Phacoemulsification

2 side ports were made at 2 o'clock and 10 o'clock positions with a 15 degree MVR blade. Injection of tryblu to stain the capsule. Injection of viscoelastics to maintain anterior chamber. A 3.0 mm keratome blade was used to make the main clear corneal incision. The three-plane incision was completed by pointing the tip of the keratome toward the lens and gradually inserting the blade. After capsulorhexis and hydrodissection, phacoemulsification was performed. IOL was injected in the posterior chamber IOLs. The viscoelastic agent was removed, and balanced salt solution was injected through the paracentesis tract to deepen the anterior chamber.

Statistical Analysis

Data analysis was performed using statistical software package SPSS version 22.0. Both descriptive and inferential statistics were used student's two-tailed t-tests were used to compare measurement data between the two groups. Pearson's chi-square test was used to compare percentages between the two groups. P value of less than 0.05 was considered significant.

Table 2

	3-bend cystitome n=90	2-bend cystitome n=72	P value
Mean Completion time of CCC(seconds)	5.9 ± 2.5	9.3 ± 4.0	<0.01
Mean no. of Times of OVD supplemented	0.4 ± 0.2	1.7 ± 0.8	<0.01
CCC success rate (%)	96.7%	86.1%	<0.01
Corneal Edema(%)	1.1% (1 eye)	11.1% (8 eyes)	<0.01

The mean CCC completion time was 5.9 +/- 2.5 seconds in the 3-bend, case group and 9.3 +/- 4.0 seconds in the control, 2-bend group (P<0.001). The mean number of times for viscoelastics supplemented was 0.4+/-0.2 in the 3-bend group and 1.7 +/- 0.8 in the 2-bend group (P<0.001). CCC was completed successfully in eyes 87 (96.7%) for the 3-bend group, whereas the success rate in the 2-bend group was 62 eyes (86.1%) (P<0.001). Postoperative corneal edema was noted in 1 eye and 8 eyes in the 3-bend and 2-bend groups, respectively (P<0.002). The intraocular pressure in the immediate post-operative period and the best corrected visual acuity at 3 months post operatively was comparable between both groups. No posterior capsular rupture or any other major complications were noted in either group. Polymethyl methacrylate or acrylic intraocular lens was implanted in the capsular bag in all eyes.

DISCUSSION

An ideal CCC for a cataract surgery is of utmost importance. It is suggested that a capsulorhexis of 5.5 mm is a safe lower limit for manual nucleus expression and it is recommended that one measures the rhexis opening routinely during ECCE.[7] Maintaining an adequate anterior chamber depth(ACD) is the prerequisite of performing a CCC with success. If the anterior chamber becomes shallow and viscoelastics are not added, pressure from the vitreous body pushes the lens upward, which increases zonular tension. Consequently, there is a greater risk of capsular flap tear at the periphery. Once the capsular flap is unstable, it can extend around the equator into the posterior capsule, thus compromising it and eventually the entire integrity of the capsular bag. Finally, it may lead to vitreous loss, inability to implant an intraocular lens, residual lens matter and a suboptimal intraocular lens site and stability [8–11]. Sparrow *et al* demonstrated that a torn posterior capsule was the sole potentially modifiable adverse risk indicator and was strongly associated with Vision loss [12]. When it goes beyond a certain limit, the disproportion between the size of the capsulorhexis and the nucleus may result in complications. Hence the need of a near perfect CCC.[13,14] Ernest introduced the concept of the posterior corneal lip to stop fluid leaving from the anterior chamber [15]. This lip was also intended to prevent hyphema. The posterior corneal lip has proved to be more essential than the long scleral tunnel with vertical cuts in the tunnel floor. The three-step procedure leaves an internal lip, which comprises endothelium, Descemet's membrane, and stroma. The internal lip seals on itself once the intraocular pressure becomes normal. The posterior lip also stops the viscoelastic agent from flowing out of the anterior chamber. Thus, to keep a stable ACD, the posterior lip should not be stressed. However, novice cataract surgeons often press the posterior lip inadvertently when they solely focus on the capsular flap being processed. This common mistake that a novice makes would be more severe once employing a standard 2-bend cystitome.The 2-bend cystitome has only one straight arm, which invariably presses the posterior lip once performing a CCC, allowing the viscoelastic agent to escape and failing to maintain the ACD. A 3-bend cystitome is comparable to a human arm, with the center bend mimicking the elbow. The posterior arm conforms to the angle of the

posterior lip, and the ACD is kept stable once the anterior arm moves to perform a capsulorhexis. Perfect visualization is of importance when performing a capsulorhexis. The 2-bend cystitome produces wrinkles around the corneal incision once pressing the posterior lip, obscuring any observation of flap tearing. In distinction, a 3-bend cystitome doesn't stress the posterior lip, so that there is no distortion of the cornea and clear visualisation is maintained.(Figure 2)

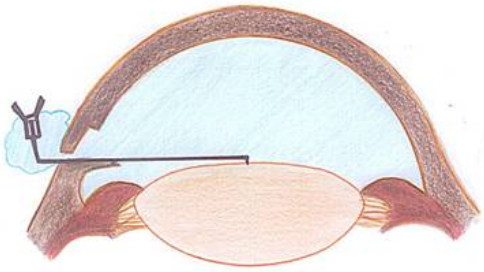

Figure 2A

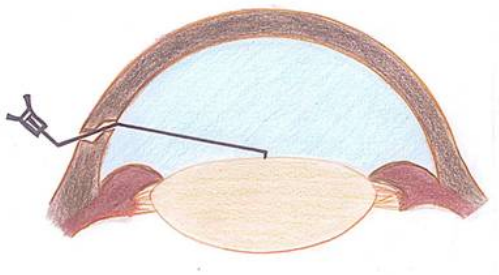

Figure 2B

Figure 2A: The conventional 2-bend cystitome has just the one straight arm, which ends up pressing the posterior lip of the wound while performing a CCC leading to the viscoelastic escaping and failing to sustain the ACD.
Figure 2B: On the other hand, a 3-bend cystitome like our arm, the middle bend being the elbow; the posterior arm thus conforms to the angle of the posterior lip, and the ACD is sustained when the anterior arm drives the tip to perform a CCC.

Our study suggests that performing CCC in a cataract surgery using the 3-bend cystitome ends up in a better success rate with lesser surgical time when compared to surgery using a 2-bend cystitome. The drawback of the 3-bend cystitome, like the 2-bend cystitome, is that it must be made prior to surgery. This takes more time in comparison to capsulorhexis forceps. In hypermature cataracts with a liquefied cortex, the capsulorhexis forceps technique is still in preference because a cystitome needle will not get the necessary counter pressure for engaging the capsule. However, a cystitome is the most popular for CCC in most cases, as forceps occupy extra space and cannot sustain a stable ACD.

CONCLUSION

The 3-bend cystitome allowed adequate visualisation into the anterior chamber from lack of wound deformation and helps maintain the anterior chamber depth due to an intact posterior lip. A 3-bend cystitome is also cost efficient and permits a safer and an effective CCC procedure.

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